De Beers
CANADA

2009 Diamond Drilling Program – Logan Kimberlite

For the Period: May, 2009

RECEIVED
APR 27 2010
GEOSCIENCE ASSESSMENT
OFFICE

A Report Prepared for

De Beers Canada Inc.

Prepared by:

R.W. Avery, P.Geo

Toronto, ON.

March, 2010

2.44717

File: Logan_assmnt_rpt.wd

SUMMARY

During May 2009, De Beers Canada Inc. completed one NQ corehole (99.0 m) in the Logan kimberlite pipe several kilometres south of the Victor Mine in northeastern Ontario. The purpose of the helicopter portable drilling was to determine the presence of kimberlite in the Logan target area and provide sample material for petrographic studies and microdiamond sampling.

KEYWORDS

Ontario, Attawapiskat, Victor Mine, Logan kimberlite, exploration, helicopter portable diamond drilling, geology, drillhole logs, core logging.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

During May 2009, one NQ diameter drillhole (99.0 m) was completed in the Logan target area in order to confirm the presence of kimberlite at this location.

1.1 Location and Access

The project area is located within NTS mapsheet 43B/12 which is located in the central James Bay Lowlands of northeastern Ontario (Figure 1). The location of the Logan kimberlite relative to De Beers Canada Inc's 100% owned Victor Mine is shown in Figure 2.

The Victor Project area is located approximately 90 kilometres west of the First Nations community of Attawapiskat. No year-round road access exists in the area. The Victor Mine is located 350 km from the nearest all-weather road and is only accessible year round by fixed-wing aircraft landing on a 1,000 m long gravel airstrip located adjacent to the mine site.

Fuel, heavy equipment and bulk materials are delivered to site each winter via a 240 km long ice road which links Moose Factory and the community of Attawapiskat. A temporary 110 km long winter road links Attawapiskat and the Victor mine site.

In its development of the Victor Project, De Beers is committed to sustainable development in local communities within northern Ontario and is signatory to four separate community agreements:

- an impact benefit agreement (IBA) with the Attawapiskat First Nation (November 2005),
- a working relationship agreement with the Taykwa Tagamou First Nation (May 2005),
- an IBA with Moose Cree First Nation (September 2008) and
- an IBA with Kashechewan and Fort Albany First Nation (February 2009)

1.2 Dispositions and Ownership

Currently, De Beers Canada Inc. holds 80 claims and 16 mining leases in the greater Victor Project area. All of these claims occur in the Porcupine Mining Division of northeastern Ontario. Upwards of 179 additional claims held by competitors surround De Beers' landholdings in the area.

As shown in Figure 3, the Logan kimberlite situated in mineral permit 4242476 is enclosed by four contiguous claims. The relative sizes and associated annual assessment requirements on claims in the Logan target area are listed in Table 1.

All of the claims are 100% owned by De Beers Canada Inc.

Table 1: List of Dispositions – Logan Kimberlite – March, 2010.

Claim Number	Claim Date	Anniversary Date	Claim Size (ha)	Assessment Commitments
P 4242476	01-June-2009	01-June-2011	64	$ 2,400.00
P 4242487	01-June-2009	01-June-2009	128	$3,200.00
P 4242488	01-June-2009	01-June-2009	64	$ 1,600.00
P 4242489	01-June-2009	01-June-2009	32	$ 800.00
P 4242490	01-June-2009	01-June-2009	16	$ 400.00

1.3 Topography and Drainage

The Victor Project area lies within the Hudson Bay Lowlands (Figure 5) and as in most parts of these lowlands, the countryside is a typically monotonously low, swampy plain that is poorly drained with numerous shallow lakes and widespread bogs.

Towards the north, the Hudson Bay Lowlands are broken by a broad rise, some 160 km long and 80 km wide that is roughly outlined by the 120 m contour that lies aside Cape Henrietta Maria Arch which presents a broad, subdued promontory that stretches inland from Cape Henrietta Maria to the southwest corner of the lowlands (Figure 5) (Thorleifson *et al.*, 1993). The major axis of the rise and its highest point consists of an inlier of Proterozoic and Precambrian rocks which form an imposing cuesta, up to 150 m in height that crosses Cape Henrietta Maria Arch at right angles in the vicinity of Sutton and Hawley Lakes (Bostock, 1976).

Surficial materials throughout the James Bay and Hudson Bay Lowlands are dominated by till, marine deposits and peat (Sado and Carswell, 1987). Surface glacial lineations oriented parallel to the former glacial ice flow direction as mapped by Prest *et al.* (1968) indicate a pronounced southwest-northeast direction in the Severn River basin and a pattern of converging southward flow in the Winisk River drainage further towards the southeast.

Major rivers of the Hudson Bay Lowlands include the Harricanaw, Moose, Albany and Attawapiskat which flow into James Bay, and the Winisk, Severn, Hayes, Nelson and Churchill rivers which flow into Hudson Bay (Cummings, 1968). The source of these low gradient rivers is mainly in Precambrian higher ground bordering the lowlands.

The main drainage pattern in the central Hudson Bay Lowlands is roughly controlled by the Cape Henrietta Maria Arch which forms an irregular divide between streams flowing northward into Hudson Bay and those flowing eastward to James Bay (Bostock, 1968). The present day drainage pattern further reflects the presence of the two large basinal features: the Moose River Basin in the south, and the larger Hudson Bay Basin to the north (Figure 5). Rivers whose outlet is Hudson Bay show a large scale radial drainage pattern, whereas rivers which drain into James Bay have become adjusted to structures in the underlying sedimentary rock sequence (Cumming, 1968). Most lakes in the area have little accompanying valley and many are shallow (Bostock, 1968).

The Victor project area straddles the Attawapiskat River whose drainage basin comprises an area of about 49,000 km^2 which extends for 670 km in a westerly direction from James

Bay (Figure 5). In it lowermost 400 km, the channel of the Attawapiskat drops only 183 m at a uniform rate of 0.4-0.6 m/km (Cumming, 1968). From the junction with the Muketei River, the Attawapiskat follows a slightly south of east course for 240 km to James Bay where the river angles across reefal limestones of the Attawapiskat Formation.

1.4 Climate and Vegetation

The Victor Project area is characterized by a humid microthermal arctic climate (Köppen classification: Dcf) (Martini, 1989). Summers are cool and four to five months long, with maximum precipitation occurring during the period July through September. Winters are very cold and snowy. The region lies exposed to outbreaks of cold air from the arctic regions during all seasons and to occasional incursions of warm air from the south in the summer. The lack of major topographic features in the region means that local climates are dependant of variations in terrain, vegetation and drainage.

In winter, the movement of weather systems over the Hudson Bay Lowlands is related to the dominance of a low pressure vortex situated over the northern half of Baffin Island. During the summer season this weather system weakens and retreats northward (Maxwell, 1986). Winter is characterized by generally west to southwesterly flow, whereas during summer, a generally less intense westerly flow prevails. During summer, this westerly flow allows warm, moisture-laden air from the south to influence the area. November and December are typically the months of the most extreme and highest monthly mean wind speeds, with average winds on the order of 20-25 km/hr during this period (Maxwell, 1986).

Similar to most areas of Canada's north, the Hudson Bay Lowlands do not conform to the four season pattern which normally prevails in southern Canada. Autumn lasts from early September through October and is the stormiest time of the year, as cold arctic air masses re-assert themselves in east-west paths moving progressively further southward. Winters are typically long and cold lasting from November to May. In January the mean daily temperature is -27°C over central Hudson Strait and -20° to -22°C over James Bay. The spring season is a late one compared to spring further south wherein mean daily temperatures are in the -5° to -10°C range. Spring is typically a short transitional period in the Victor project area lasting from May to June, characterized by rapid lengthening hours of daylight, above freezing temperatures, and diminishing snow cover. The remaining two months of the year, July and August, comprise a generally cool, cloudy summer, extending from the time the tundra is finally clear of snow and appreciable amounts of sea ice have disappeared, until the first snow flurries of autumn. During these months, the temperature of the vast, cold surfaces of James and Hudson Bays contrasts sharply with the surface layers of the atmosphere, resulting in extensive fog and cloud cover.

Much of the Hudson Bay Lowlands are characterized by patchy discontinuous permafrost. The presence of permafrost has an important impact on the summer climate of the area since it is at least partially responsible for the water-logged state of the terrain. Water from melting snow or spring rains is unable to penetrate the frozen ground; instead it collects in puddles, small ponds and shallow streams. The result is a wet, swampy surface – evaporation from which consumes heat energy in the summer which could otherwise be available to increase the ambient air temperature (Maxwell, 1986).

More than 90% of the Hudson Bay Lowland is occupied by unconfined wetland (muskeg) most of which has developed into peatlands characterized by a variety of peat types and thicknesses, depending on location and climate (Martini, 1989). The distribution of wetlands types and variation in vegetation across the region is dictated by the strong north-south temperature gradient, by the coastal inland position as well as the local topography and substratum. The mid-boreal wetland region (B_{Mh}) which comprises ground cover in the Victor area largely consists of black spruce, Labrador tea, vaccinium, bog rosemary and cloud berry. Better drained sites are dominated by open stands of black spruce with understories of dwarf birch, Labrador tea and lichen. Drier sites may also include stands of white spruce and paper birch with a discontinuous understory of bearberry and bog cranberry. White spruce, paper birch and trembling aspen are found primarily on protected, warm sites (Thorleifson, *et al., 1993).*

1.5 Planning, Permits and Environmental Management

As part of De Beers' ISO 14001 Environmental Management System (EMS) work programs are required to adhere to all regulatory Acts, legislation and guidelines as they apply to waste management, storage and disposal.

Prior to the commencement of work in the Logan kimberlite area, permits were required from four separate Government of Ontario ministries: the Ministry of the Environment (MOE), Ministry of Natural Resources (MNR), Ministry of Labour (MOL), and the Mining Occupational Health and Safety Branch (MOL).

In November 2008, De Beers Canada submitted a detailed exploration/evaluation program plan to the Mining Occupational Health and Safety Branch which outlined all anticipated environmental impacts caused by the proposed drilling activities. Authority to withdraw surface water for drilling activities was obtained through a *Permit to Take Water* (PTTW) issued to De Beers by the Ministry of Environment for the period February-July, 2009.

Diamond drilling activities in the program area were regulated by a *Notice of Mining Activity for Delineation Drilling* issued to De Beers for the period February through June 2009. A work permit issued by the Ministry of Labour provided for extended work hours for personnel during the project.

All individuals working on site handling hazardous goods or materials are trained by De Beers in the safe handling and transportation of dangerous goods (TDG). All drilling rig waste (waste oil, rig wash, grease, oil filters) was collected in containers and transported off-site to approved disposal sites at the Victor Mine.

As part of its Environmental Management System, De Beers maintains an Emergency Response Plan (ERP) for its exploration activities which outline specific written guidelines for leak and spill response procedures. Additional mandatory training for all workers on site (both De Beers personnel and external contractors) consists of Environmental Awareness Training, Spill Awareness, Petroleum Products Handling, Emergency Response, Helicopter Safety, Camp Awareness and Construction Awareness training. Other legislated courses such as TDG, WHMIS, Propane Handling and general First Aid are also provided for employees who require additional training in their work.

2.0 GEOLOGY

2.1 Previous Mapping

Scientific study of the geology of northern Ontario was undertaken by the Geological Survey of Canada (GSC) as early as the late 1860's. Robert Bell of the GSC (1866-1887) first documented the general character of glaciation in northern Ontario. He measured striae indicating southwestward ice flow at sites in northern Manitoba and across northern Ontario to the eastern coast of Hudson Bay. The ice sheet model developed by Bell prior to 1890 differs little from the present day interpretation of the Quaternary history for the region.

In 1967 the GSC carried out Operation Winisk, a multidisciplinary helicopter supported reconnaissance mapping project that covered a 337,000 km^2 area in the Hudson Bay Lowlands and adjacent Precambrian terrain (Norris and Sanford, 1968). Knowledge of the area was also greatly increased by the reconnaissance study of ever major river in the lowland by a group led by Macdonald (1969).

An earth science symposium convened by the Geological Survey of Canada in 1968, examined the bedrock geology (Bostock, Norris and Sanford, 1968) and late-glacial history (Craig, 1968) of the Hudson Bay Basin. Aspects of the climate and drainage of the region were also examined by Maxwell (1986) and Cummings (1986). The Paleozoic stratigraphy of the Hudson Platform is described by Norris and Sanford (1968), Sanford and Norris (1975), Norris (1986) and Sanford and Grant (1990). The Quaternary stratigraphy of the region is described by Shilts (1986), Sado and Carswell (1987), Skinner (1973) and more recently by Thorleifson *et al.*, (1993).

2.2 Regional Geology

The Victor project area is underlain by Paleozoic, Proterozoic and Archean rocks (Figure 5). Paleozoic strata in the area range in age from Upper Ordovician to Middle Silurian and consist almost exclusively of carbonates that dip gently northward from their position on the southern flank of the Hudson Bay sedimentary basin (Norris, 1986). Proterozoic rocks dominated by slightly metamorphosed sediments and diabase, outcrop in the Sutton Inlier between Winisk River and James Bay, as well as throughout eastern Hudson Bay in the area surrounding and including the Belcher Islands.

2.3 Archean Rocks

The oldest rocks in the area which are of Archean age, are assigned to the Superior Province of the central Canadian Shield (Figure 4). On the basis of areal distribution, about 60% of the rocks in the Superior Province consist of granitic plutons and granitic gneiss (Donaldson, 1986). Most of these rocks show moderate to distinct foliation. Less common are layered gneisses, migmatites and hybrid rocks which tend to occur in easterly trending linear belts. About 20% of the Superior Province consists of volcanic and sedimentary rocks that are closely associated with elongate to irregular greenstone belts, most of which display a marked easterly trend. Although greenstone belts are commonly extensively deformed, the grade of metamorphism is generally low (greenschist facies) so that many primary volcanological and sedimentary structures are often preserved. Basalt and its metamorphosed equivalent present the most common rock types in greenstone belts, followed by andesite, dacite, rhyodacite and rhyolite (Donaldson, 1986). Where the stratigraphy is uninterrupted by folding or faulting, volcanic sequences tend to progress upward from mafic to felsic. It is currently uncertain if many or all of the greenstone belts are relics of more extensive basins or oceanic crust, or whether they represent highly deformed relics of numerous small basins (Card, 1990).

The structure of the Precambrian sediments over the axis of Cape Henrietta Maria Arch and its southern flank appears to be broadly homoclinal with northeastward dips of generally 10° or less (Figure 6). The Hudson Bay Basin to the north and Moose River Basin to the south occur as flanking Paleozoic basins on either side of the arch which fill depressions in the Archean basement.

The latest radiometric age imprinted almost everywhere on rocks in the Superior Province is approximately 2.5 Ga which represents the age of a period of regional uplift during the Kenoran Orogeny. This age defines the Archean-Proterozoic boundary and indicates the minimum age of cratonization of the Superior Province. Two granodiorites dated by Bostock (1971) by the K-Ar method returned ages of 2505 ± 65-70 Ma.

2.4 Proterozoic Rocks

The distribution of exposed Proterozoic rocks in the Hudson Bay Platform follows a discontinuous northward trending concave belt that stretches southwest across James Bay, northwestward through Sutton Lake to the Winisk inlier (Figure 5). Aeromagnetic anomaly patterns characterized by short wavelength (birdseye type) high and low intensity anomalies, chiefly less than 3000 nT above and below background, roughly follow this outcrop distribution as far as Sutton Lake (Bostock, 1971).

The broad rise that lies aside Cape Henrietta Maria Arch contains a series of Proterozoic carbonates that unconformably overlie Archean granitic rocks along the southeastern flank of the inlier. Therein, Bostock (1971) has described a sequence of dolostone, cherty dolostone, stromatolitic dolostone, some siliceous calcareous argillite, limestone and dolomitic limestone. A second unconformity at the upper contact of the Nowashe Formation is overlain by chert breccias, conglomerate and quartzite with minor slate apparently derived from the underlying siliceous carbonates. A 100 m thick diabase/gabbro sill is seen to cap the top of the Sutton Ridge Formation.

2.5 Phanerozoic Rocks

The Hudson Platform consists of the erosional remnants of two adjacent basins: the Moose River Basin to the south, and the much larger Hudson Basin to the north (Figure 5) which together, encompass an area of approximately 970,000 km^2 (Norris, 1986). About two-thirds of the basin area is covered by water of Hudson and James Bays. The Phanerozoic sequence consists of nearly flat lying to gently dipping sedimentary rocks that have an areal map pattern which roughly coincides to the physiographic limits of the Hudson Bay Lowlands. Consequently, the sparse and widely separated rock exposures are confined mainly to coastal regions and along deeply incised rivers which flow into Hudson and James Bays. Figure 7 indicates the regional Paleozoic stratigraphy of the Attawapiskat area.

The Hudson Bay and James Bay Basins are separated by the northeast trending Precambrian basement high referred to as Cape Henrietta Maria Arch. In cross-section (Figure 6), the arch is seen to act as a broad hinge area from which Paleozoic rocks dip south into the Moose River Basin where they reach an estimated thickness of 850 m, and northwest into the Hudson Basin where they reach a maximum thickness of 1,830 m in the central offshore part of the basin (Sanford *et al.*, 1968)

The Paleozoic and Mesozoic succession in the Moose River Basin includes Ordovician, Silurian, Devonian, Middle Jurassic and Lower Cretaceous rocks. In Hudson Bay Basin the succession consists of Ordovician, Silurian and Devonian rocks (Norris, 1986).

2.5.1 Ordovician Stratigraphy

The oldest Paleozoic rocks of the Hudson Platform are of late Middle Ordovician (Caradocian) and Late Ordovician (Ashillian) age (Norris, 1986). These rock units form narrow belts of outcrop along the southwest margin of the Hudson Bay Lowland, in the Quebec Embayment of the Moose River Basin, and on Southampton and Coats islands at the north end of Hudson Bay Basin (Figure 5).

Ordovician age rocks in the Victor Project area are divided into the Bad Cache Rapids Group, Churchill River Group and the Red Head Rapids Formation (Figure 7). They rise to surface along the western margins of the lowlands extending from the delta of the North Knife River in the north, to the Kenogami River in the south where these rocks are truncated by a fault. The maximum known thickness of Ordovician rocks (undivided) is 82.5 m in the Moose River Basin.

Bad Cache Rapids Group

The Bad Cache Rapids Group describe Ordovician strata of the northern Hudson Bay Lowland that unconformably overlie peneplaned Precambrian rocks and are succeeded by limestone rocks of the Churchill River Group. In its type section, the Bad Cache Rapids Group is divided into the Portage Chute and Surprise Creek formations, in ascending sequence. These are useful formational terms in the immediate type area, but are difficult to apply in the subsurface and are seldom used regionally (Norris, 1986).

In its type section on the Churchill River, the Bad Cache Rapids Group is about 40 m thick and 71-91 m in central offshore Hudson Bay. The Bad Cache Rapids Group is recognized throughout the Hudson Bay Basin, but appears to thin and pinch-out over Cape Henrietta Maria Arch. The formation is not recognized in the Moose River Basin (Norris, 1986).

The lithology of the Bad Cache Rapids Group consists of a basal transgressive calcareous quartz sandstone overlain by microcrystalline dolostone and bioclastic limestone exhibiting common nodular bedding. Where recognized, the overlying Surprise Creek Formation consists of finely crystalline cherty dolomitic limestone.

Shelly fossils of the Bad Cache Rapids Group on Southampton Island suggest a correlation with the Farr Formation of the Lake Timiskaming outlier and the upper Cobourg beds of the Trenton Group in south-central Ontario (Norris, 1986).

Churchill River Group

The Churchill River Group disonformably overlies the Bad Cache Rapids Group and is conformably overlain by the Red Head Rapids Formation. In its type area it is subdivided into the Caution Creek and Chasm Creek formations which are not recognized outside the type section area.

Rocks of the Churchill River Group occupy a narrow belt in the western Hudson Bay Lowlands which are truncated by faulting along the southern margin of the Moose River Basin (Figure 6). On Cape Henrietta Maria Arch, they overlap the Bad Cache Rapids Group and rest directly on Precambrian rocks. The thickness of the Churchill River Group is about 90 m in southern Hudson Bay Basin, 53 m on Southampton Island, and between 96 and 114 m offshore in central Hudson Bay (Norris, 1986).

In its type area, the Churchill River Group consists of microcrystalline dolomitic limestone with common skeletal fragments (Caution Creek Formation). The conformably overlying Chasm Creek Formation consists of iron-rich dolostone to slightly dolomitic limestone with common trace fossil markings. Common shelly fossils in the Caution Creek Formation correlate with the Stony Mountain Formation in southern Manitoba (Norris and Sanford, 1968).

Red Head Rapids Formation

The Upper Ordovician Red Head Rapids Formation describe dolostones and calcareous dolostones that overlie the Churchill River Group and are succeeded unconformably by limestones of the Silurian Severn River Formation. The unit is recognized in both basins of the Hudson Platform. In the Moose River Basin it overlaps the Churchill Group to rest directly on Precambrian basement rocks (Figure 6).

The thickness of the Red Head Rapids Formation is about 32 m at its type location in the Churchill area, about 61 m on Southampton and Coats islands, and between 88 and 98 m offshore in the central part of Hudson Bay (Norris, 1986).

In its type section, the Red Head Rapids Formation consists of platy, orange weathering beds calcareous microcrystalline dolostone. The formation is also noted to contain inclusions of anhydrite and minor thin interbeds of shale. Evaporites up to 20 m thick in the Red Head Rapids Formation consisting of anhydrite and salt have been intersected in two offshore wells in central Hudson Bay. Thin sequences of anhydrite have also been encountered in several drillholes on the mainland adjacent to the southern periphery of Hudson Bay Basin and in two boreholes in the Moose River Basin.

The sparse shelly fossil assemblage of the Red Head Rapids Formation suggests correlation with the Stonewall Formation of southern Manitoba (Norris and Sanford, 1968).

2.5.2 Silurian Stratigraphy

Silurian rocks are widely distributed throughout the Hudson Platform (Figure 5). They are separated from underlying Ordovician rocks by a hiatus of some magnitude which includes the Gamachian of the Ordovician and all of the Lower Llandovery of the Silurian (Norris, 1986).

Middle and Upper Silurian carbonates sequences in the Hudson Bay Lowlands are represented by four major rock units. In ascending order these are: the Severn River, Ekwan River, Attawapiskat and Kenogami River formations. The uppermost sequence, the Kenogami River Formation is not present in the Victor area (Figure 7). Their combined thickness varies from about 365 m in the Moose River Basin to more than 450 m in Hudson Bay Basin. Silurian rocks rise to the surface along the western margin of the Hudson Bay and James Bay and form the youngest strata across the intervening Cape Henrietta Maria Arch (Norris and Sanford, 1968). These strata are truncated along the southern margin of the Moose River Basin by a major fault where they are overlapped in part by Devonian and Cretaceous rocks. Widely spread Silurian exposures occur along the tidal flats between Churchill, Manitoba and Normansland Point Ontario and along many rivers in Manitoba, Ontario and Quebec that flow into Hudson and James Bay.

Severn River Formation

The Severn River disonformably overlies the Upper Ordovician Red Head Rapids Formation and is succeeded by the Ekwan River Formation. In local areas in either basin, Severn River strata overlap the Ordovician to rest unconformably on Precambrian basement high rocks (Figure 6). Recorded thicknesses of the Severn River Formation vary from a maximum of 248 m in the central offshore part of Hudson Bay to a minimum of 45 m in the northern portion of the Moose River Basin (Norris, 1986).

In outcrop, the Severn River Formation consists of a heterogeneous assemblage of limestone, dolomitic limestone and dolostone. Some beds are burrowed and mottled, whereas others contain even and regularly layered algal mats. Basal beds of the formation are commonly sandy and conglomeratic where they overlap Precambrian basement rocks.

The lower strata of the Severn River containing *Virgiana* sp. are generally regarded as basal Middle Silurian, and presumably equivalent to rocks bearing these fauna in the Dyer Bay Formation in southwestern Ontario and the basal Interlake Group in southern Manitoba (Norris and Sanford, 1968).

Ekwan River Formation

The Ekwan River Formation describes strata that conformably succeed the Severn River Formation and in turn, are conformably overlain by reefal carbonates of the Attawapiskat Formation.

Parts of the Ekwan River Formation are well exposed in several areas of the Moose River Basin. The formation is also widely distributed on Southampton, Mansel and Coats islands in the Hudson Bay Basin. Representative thicknesses of the formation are 40 m in northern Hudson Bay Lowlands, up to 235 m in central offshore Hudson Bay, and upwards of 90 m on islands in the northern portion of the Hudson Platform (Norris, 1986).

Strata of the Ekwan River Formation consist of well bedded, skeletal and pelletoidal limestone and finely crystalline dolostone that locally swell into irregular, massive bioherms. Varying amounts of nodular chert, detrital carbonate and skeletal fragments form a high percentage of this sequence in some places.

The Ekwan River Formation contains an abundant and diverse shelly faunal assemblage which include stromatoporoids, corals, brachiopods and cephlapods. Faunal divisions in the upper portion of the formation indicate a Late Llandovery age which is correlated with the Thornloe of the Lake Timiskaming outlier, Fossil Hill and Amabel Formations of southern Ontario, and the Interlake Group of southern Manitoba (Norris and Sanford, 1968).

Attawapiskat Formation

The Attawapiskat Formation describes an assemblage of reefal carbonates that overlie the Ekwan River Formation and are in turn overlain by the lower member of the Kenogami River Formation. These carbonates appear to incompletely surround and cover the flanks of the Moose River and Hudson Bay Basins (Figure 5). In outcrop, the Attawapiskat Formation is most fully developed on the northwestern and southeastern flanks of Cape Henrietta Arch which appears to have acted a stable platform on which the Attawapiskat Formation developed as a barrier reef complex during middle Silurian time (Norris and Sanford, 1968).

The thickness of the Attawapiskat Formation varies from 62 m in northern Hudson Bay Lowland to 53 m on Southampton, Coats and Mansel islands.

Two predominant lithofacies: reef and inter-reef facies are present in the formation. In outcrop, the most conspicuous of these facies is presented by swarms of bioherms that are tens of metres wide and up to 10 m high. These consist of variably textured microcrystalline fragmental limestone with algal stromatoporoids and halysitid corals. Coarse vugs are also locally present within the bioherms. Flanking inter-reef facies are more uniformly bedded and consist of lime mudstone and dolostone with numerous coarse, granular textured detrital beds (Norris, 1986).

Shelly fossils from the Attawapiskat Formation indicate a latest Llandovery or early Wenlock age (Norris, 1986). The bioherms and associated carbonate rocks of the formation are similar in lithological character to the late Middle Silurian Guelph Formation of southwestern Ontario as well as the Chemahawin Member of the Cedar Lake Formation in southern Manitoba (Norris and Sanford, 1968).

2.6 Quaternary Geology

Although the Hudson Bay Basin has been glaciated several times during the past million years, most of the sedimentological characteristics of the present day landscape are inherited from the last (Wisconsin) glacial episode.

The examination of hundreds of kilometres of stratigraphic section along rivers and streams in the Hudson Bay Lowlands have led to controversial and conflicting conclusions about the history of glaciation in the Hudson Bay Lowlands (e.g. Skinner, 1973, Shilts, 1986 and Thorleifson *et al.*, 1993).

The Quatemary stratigraphy of the Hudson Bay Lowlands suggest that no less than four glacial events preceded by at least one interglacial episode have occurred. Evidence of four pre-Wisconsin glaciations is present at one site on the Missinaibi River where four tills underlie the interglacial foreset beds of the Missinaibi Formation (Skinner, 1973 and Thorleifson *et al.*, 1993). The light grey lower till at this site is directly overlain by a maroon colored till that is separated from two overlying grey tills by fluvial deposits. The uppermost grey till is directly overlain by the Missinaibi Formation which consists of marine, forest, peat, fluvial and lacustrine beds which were deposited during a climatic interval similar to the present day interglacial. The Missinaibi Formation is >75000 ^{14}C years old which is confirmed by amino acid data (Shilts, 1986) and is correlated with the Sangamon interglacial stage of Skinner (1973).

Since the Missinaibi nonglacical interval, as few as one and as many as three major expansions of the Laurentide Ice Sheet are recognized in the Hudson Bay Lowlands. South of James Bay, Skinner (1973) identified two glacial events represented by two till sheets separated by glaciolacustrine sediments in and adjacent to the Moose River Basin. Macdonald (1969) recognized a similar bipartite division of the Wisconsin throughout the westem Hudson Bay Lowland at least as far north as Churchill, Manitoba. Shilts (1986) recognized that some or all parts of the Hudson Bay Lowland may have been subjected to three Wisconsin glacial events based on physical stratigraphic relationships (three tills overlying interglacial beds) supported by aminostratigrahic evidence based on isoleucine racemization ratios (alle:Ile) of marine shells found as erratics in till and in-situ in marine silty clays. These lines of evidence suggest that more than one opening of Hudson Bay occurred after the Sangamon stage.

The late Wisconsin glaciation of the Hudson Bay Lowlands likely consisted of a continental ice sheet containing several centres of outflow that shifted position and interacted with each other in complex manners throughout space and time (Shilts, 1986). Regional trends in the orientation of longitudinal glacial landforms initially mapped by aerial photography have more recently been confirmed by satellite imagery which indicates the generally southwest trend of former ice flow, punctuated by a zone of south-southeast flow extending from the Winisk River to the Albany River. Horsefield (1987) utilized satellite imagery supplemented by field work to propose ice flow from centres in the Keewatin, Ungava and southern Hudson Bay during Early, Middle and Late Wisconsin time, respectively. Boulton and Clark (1990) concluded that the ice flow history of the Hudson Bay Lowland involved: 1) possible pre-Wisconsin southeastward flow, 2) a poorly defined episode of flow from Quebec and possibly Keewatin, 3) west-southwestward Early Wisconsinan flow prior to intra-Wisconsinan deglaciation, 4) a late Wisconsinan pattem involving southwestward ice flow in adjacent areas but unclear patterns in the Hudson Bay Lowland, and 5) Cochrane-equivalent south-southeastward flow extending into the Winisk River area.

Notwithstanding the combined influences of the various glacial events that have modified the surficial geology of Hudson Bay Lowlands over the past several hundred thousand years, by far, the most important glacial episode with respect to the present day landscape has been the pattem of late Wisconsin deglaciation.

As the Laurentide Ice Sheet shrank toward centres that approximate the positions of its major gathering grounds in central Keewatin, Foxe Basin and Quebec-Labrador, the weight of the ice mass caused displacement of the earth's mantle and depression of the land surface to elevations 100-300 m below the present day surface (Shilts, 1986). Thus, as the Laurentide Ice Sheet shrank, sea water re-entering Hudson Bay through Hudson Strait was at a much higher level than at present, and areas adjacent to Hudson and James Bay were inundated. This early configuration of Hudson Bay has been termed the Tyrrell Sea by Lee (1960) and because isostatic uplift is still on-going, Tyell Sea and modem Hudson Bay merge at the presentday shoreline.

Just prior to the opening of Hudson Bay to marine waters, large proglacial lakes fronted the glacial margin to the south and west. These lakes drained southward and westward through various routes into the St. Lawrence and Mississippi river systems. As early as 7800 ^{14}C years BP, marine waters had penetrated the ice sheet as far south as James Bay. Assuming initial marine incursion at 7800 ^{14}C years, and that marine deposition was occurring near the Keewatin Ice Divide by 6000 ^{14}C years BP, the rate of glacial retreat in the Hudson Bay Lowlands is estimated by Shilts (1986) to have averaged around 300 m/year.

The ice sheet that filled the northwest part of Hudson Bay after the initial incursion of marine waters into James Bay was relatively stagnant as indicated by the extensive network of eskers that are now exposed on land. Major slowdowns or stillstands in the retreat of the ice front are also marked in the Keewatin by zones of increased esker density.

Nearshore features marking the highest level of marine inundation are nearly everywhere the most prominent features developed between the marine limit and modern sea level. The marine limit is a time transgressive feature however, with the earliest marine strandlines formed in the James Bay region as early as 7900 years BP, whereas strandlines near Baker Lake formed over 2000 years later (Shilts, 1986).

3.0 ECONOMIC GEOLOGY

A variety of mineral occurrences and industrial minerals are known in the Hudson Bay Lowlands and peripheral Precambrian terrain. The southern margins of the lowlands which are proximal to existing road and rail connections have been more thoroughly investigated. In the Precambrian south of the Moose River Basin, mineral occurrences containing iron, niobium, thorium, uranium, gold, lithium and prospects containing small amounts of copper, nickel, zinc and molybdenum have been reported (Norris and Sanford, 1968).

The Paleozoic sedimentary rocks of the Moose River Basin are known to contain deposits of high calcium limestones, shale and sideritic iron. Gypsum deposits in the basin have attracted attention owing to their high purity, accessibility in outcrop and location near existing transportation links. Further to the north, salt deposits are widely distributed throughout the Hudson Bay Basin where they form part of the Ordovician Red Head Rapids Formation, the Silurian Kenogami River Formation and the Devonian Stooping River Formation. These subsurface occurrences are located mainly offshore beneath Hudson Bay and are not easily recoverable (Norris, 1986).

Oil shales occur in three stratigraphic units in the Hudson Platform: the Upper Ordovician Boas River shale, the uppermost oil shale on Southampton Island and the Upper

Devonian Long Rapids Formation in the Moose River Basin. Of these, only the Southampton oil shale has been adequately tested by analyses which indicate a potential yield of 53.6 litres of oil per tonne (Norris, 1986).

The Phanerozoic succession in the Moose River Basin is relatively thin (up to 760 m) and lacking in mature source rocks with the possible exception of the Long Rapids Formation. Although this formation has been subject to block faulting, potential reservoir rocks do not appear to be adequately sealed (Norris, 1986). Similarly, the oil and gas potential of the Hudson Bay Basin which has a much thicker Paleozoic succession, up to 1,575 m or more, has not revealed many good prospects. Sanford and Norris (1975) indicate that no authentic seepages have been found on land and that only minor shows of oil and gas have been reported in drillholes. Although the reefal Attawapiskat Formation presents several structural anomalies of potential interest in seismic data, subsequent drillholes indicate that while some petroleum generation has occurred, only a low level of thermal maturity has been encountered (Johnson, *et al.*, 1986). Deeper horizons towards the centre of Hudson Bay Basin remain presently untested and may offer some potential however.

Sporadic exploration and drillhole testing of circular intrusive structures throughout the James Bay region during the 1960's and 70's generated largely negative results. The expectation was that the anomalies would prove to be either carbonatite or kimberlite structures of economic significance. Tests on similar structures in the Kapuskasing rift belt which extends for up to 400 km south of James Bay had identified several kimberlites and carbonatites. Therein, two carbonatites proved to be of probable economic significance: one with 80 Mt >0.5% columbium pentoxide, the other, a potential source of phosphate containing 62.5 Mt averaging 20% P_2O_5 or better (Johnston, *et al.*, 1986).

Notwithstanding these early attempts at locating in situ kimberlites, discoveries of diamonds, some of gem quality, had been made throughout the last century within glacial tills and terminal moraines that form a dispersion fan originating from the Hudson Bay Lowlands.

3.1 Previous Investigations Undertaken by Monopros/De Beers

During the 1960's, Selco Exploration Company discovered kimberlitic indicator minerals in the Moose River Basin. Subsequent mapping in 1966 by the Ontario Department of Mines indentified indicator minerals as well as the presence of ultramafic lamprophyre and "kimberlitic" sills and dykes at Coral Rapids. The regional geological setting and the presence of indicator minerals prompted BP Selco and Esso Minerals to commence exploration in the region once again in 1979. Using low level airborne magnetic surveys and detailed ground geophysics to define targets, BP Selco and Esso Minerals undertook a drilling program that yielded 34 melnoite pipes from a selection of 64 geophysical anomalies (Kong, *et al.*, 1999).

In 1984, Monopros Ltd. (the forerunner of De Beers Canada Inc.) commenced a regional stream sediment sampling program up-ice of the melnoites investigated earlier by Selco. Systematic stream sediment sampling between the Kenogami and Ekwan rivers indicated a kimberlitic indicator mineral train. The compositions of mantle derived ilmenites, garnets, spinels and clinopyroxenes derived from the sampling which were distinct from the mineral assemblage associated with the Selco melnoites, implied derivation from diamondiferous kimberlites (Webb, 2004). In 1987, kimberlite boulders were discovered along a 10 km stretch of the Attawapiskat River. A 2,900 km^2 airborne magnetometer survey across the discovery area identified 31 targets for further follow-up. Detailed ground mag, EM and gravity surveys over the anomalies suggested 16 steeply dipping near surface anomalies ranging 0.4-15 ha in size. Subsequent testhole drilling of the anomalies in 1988-89 confirmed the presence of 16 kimberlite pipes (Kong *et al.*, 1999).

The Victor kimberlite subsequently proved to be the largest of 19 kimberlites in the Attawapiskat kimberlite cluster. During this period, eight holes were drilled into Victor to ensure representative samples from the various kimberlite phases in the pipe were sampled.

Using microdiamond results, petrographic and mineral chemistry ratings, the kimberlites were prioritized and four bodies were bulk sampled in 1997-98 (25 DH: 1,301.2 m), which yielded a total of 64 tonnes of sample material for macrodiamond recoveries (Kong *et al.*, 1999).

A delineation corehole drilling program in 1999-2000 provided additional information on the geometry of the Victor kimberlite preparatory to bulk sampling in 2000-2001 when 9.649 tonnes (wet) of kimberlite was recovered by reverse circulation drilling (38 DH). An additional 5,349 tonnes of kimberlite was recovered from two near-surface trenches which were excavated into the Victor pipe. The results of the drilling and trenching revealed a variable, wide grade distribution within the Victor North kimberlite, and a slightly more consistent grade in the Victor South pipe (Webb, 2004).

In 2002, resource modeling based of the bulk sample results was undertaken as were geotechnical and hydrogeological assessments of the Victor Project area. A feasibility study for the Victor kimberlite commissioned in 2003 was accompanied by additional core drilling in order to delineate various phases of contrasting grade within the pipe.

Having received all of the required approvals from federal and provincial government regulatory agencies, construction of the open pit Victor Mine began in February, 2006. The mine commenced commercial production in June 2008 with an annual processing capacity of 2.7 Mt and a carat producing capacity of 600,000 ca/annum.

3.2 Geology of the Victor Kimberlite

The ca 170 Ma Victor kimberlite is the largest composite body in a cluster of 19 kimberlites which straddle the Attawapiskat River in the Hudson Bay Lowlands, 100 km west of James Bay (Figure 2).

The Victor kimberlite comprises two adjacent but separate pipes, Victor North and Victor South, which define a collective surface area of 15 ha. The Victor South pipe is dominated by pyroclastic kimberlite, whereas Victor North is internally more complex, consisting of both pyroclastic and hypabyssal kimberlite (Webb, 2004).

In plan view, the Victor North and South pipes present a subcircular surface expression. In cross-section the pipes are steep sided, with pipe walls dipping approximately 70°. Although the pipes occur as separate bodies at surface, their close proximity and steep pipe margins suggest they likely coalesce or crosscut one another at higher levels. Both pipes appear to flare out at or just below the Precambrian/Ordovician unconformity approximately 275 m below the present day surface (Figure 7). The original thickness of Paleozoic sediments at the time of kimberlite emplacement during the Jurassic is judged to be on the order of 600 m, which suggests that the Attawapiskat kimberlites have been substantially eroded, with only half of the original pipes now being preserved (Kong, *et al.*, 1999).

The pipe shapes, infill and emplacement processes of the Attawapiskat kimberlites, including Victor, contrast with most of the southern African kimberlites. The Attawapiskat kimberlites appear to have formed by several eruptive events resulting in crosscutting and nested craters infilled by contrasting textural kimberlite types. Victor South and much of Victor North are composed of similar pyroclastic juvenile lapilli bearing olivine tuffs. The northwest portion of Victor North however, is dominated by a texturally unusual rock type resembling hypabyssal kimberlite. Webb (2004) indicates the Victor North pipe is likely the product of several successive eruptive events: 1) crater excavation and infilling of the northwestern portion of the pipe, 2) excavation of a crosscutting crater infilled by olivine phenocryst-rich pyroclastic kimberlite, and 3) eruption of olivine phenocryst-poor pyroclastic kimberlite from two vents nested within the crater. Although either phase of pyroclastic kimberlite appears macroscopically similar, they have contrasting microscopic characteristics and macrodiamond grades.

Rb/Sr dating of phlogopite from five Attawapiskat kimberlites has yielded model ages of 155-170 Ma and an Upper Jurassic emplacement age of 156 ±2 Ma for two bodies. Additional U/Pb isotope dating on perovskite separates from three kimberlites in the Attawapiskat cluster has yielded ages of 177-180 Ma which indicates a time span of some 25 Ma for kimberlite emplacement in the region (Webb, 2004).

4.0 INVESTIGATIONS

Investigations undertaken during the reporting period are summarized in Table 2.

Table 2: Summary of Investigations - Logan Kimberlite – May, 2009.

Helicopter Support:	
Helicopter Transport Services Canada (HTSC), Ottawa, Ontario	
	8.0 hrs, Bell 206L4 Longranger
	6.7 hrs, Areospatalie AS 350 B-2
Drilling:	
Foraco Canada Ltd., North Bay Ontario	1 DH, 99.0 m

4.1 Drill Program Logistics

Prior to the start of drilling, equipment was mobilized to site from Moose Factory via an existing winter road which services the Victor Mine during the winter months.

A helicopter supported corehole drilling program was undertaken in the Logan kimberlite target area during May 2009. As summarized in Table 3 and shown in Figure 8, one vertical NQ ϕ corehole was completed in the centre of the target.

Table 3: Drillhole Summary - Logan Kimberlite – May, 2009.

DH	UTM Collar Location (NAD 83)		Drillhole Orientation		Start Date	End Date	EOH (m)
	Northings	Eastings	Azimuth	Inclination			
ATT-09-005C	5832989.4	305977.8	-	-90°	01-May-09	02-May-09	99.0

Based on De Beers' past experience with spring drilling, the month of May was found to be advantageous based on the common presence of spring thaw conditions accompanied by rapidly increasing daylight hours and easy access to sources of water required for drilling.

The Victor Mine (Figure 2) served as the logistical centre for the drill program. De Beers personnel, helicopter crews and drill contractors were accommodated at the minesite. Since the Logan kimberlite target has no road access, geologists and drilling personnel were ferried to site each day by a Bell model 206L4 Longranger helicopter operated by Helicopter Transport Services Canada (HTSC) of Ottawa, Ontario.

The helicopter portable equipment used during the reconnaissance drilling program required heavier lifts than the Longranger helicopter was capable of lifting. As a result, drill moves were undertaken using an Areospatalie AS 350 B-2 helicopter with a cargo hook capacity of 1,159 kg. The A-Star 350B-2 helicopter was similarly supplied and operated by HTSC for the duration of the drilling. With both helicopters operating at the same time, drill moves were effectively halved in time compared to moves using a single helicopter. This resulted in drill moves being completed in as little as three hours.

4.2 Diamond Drilling

A skid mounted Hydracore model 2000 diamond drill and ancillary equipment operated by Foraco Canada Ltd of North Bay, Ontario was used to complete the Logan reconnaissance drilling. In addition to being particularly light weight and portable, the Hydracore drill rig has the capacity to drill HQ diameter core to depths of up to 300 metres if required. The NQ diameter core drilling capacity of the Hydracore rig is reportedly on the order of 600 m.

The drill rig was powered by two Kubota V2403T turbo diesel engines each developing 57 hp which provide effective flow capacity of 56 GPM at 3000 psi. Virtually all components on the Hydracore rig are hydraulically operated: NQ chuck, foot clamp, wireline winch and water/mud pump which has the advantage of both ease of operation and easy repair.

Core drilling during the period was accomplished using synthetic NQ drill bits with an inner diameter of 47.6 mm and an outer jacket diameter of 75.6 mm. Upon the completion of drilling, the surface casing was pulled and a van Ruth plug was set at the bottom of the kimberlite intersection. Thereafter, the hole was grouted to surface in order to prevent the interaction of surface water with any ground water.

The azimuth and inclination of the corehole was obtained by means of an electronic Reflex EZ-Shot downhole camera which measures six downhole parameters: azimuth (uncorrected for magnetic declination), drillhole inclination, magnetic tool face angle, gravity roll angle, magnetic field strength and temperature. Measurements of the orientation and inclination of the drillhole was obtained at 50 m intervals throughout the length of the hole.

The collar location of the drillhole was surveyed using a Trimble Pro-XRT GPS in conjunction with a fixed, high level accuracy base station located at the Victor minesite.

Upon the completion of logging at the main Victor camp, the boxed drillcore was stacked and assembled on pallets which were shipped to Sudbury for long term storage at the De Beers core storage facility. The Sudbury facility permits De Beers staff easy, year round access to drillcore from various projects located throughout Ontario.

4.3 Core Logging

Field logs summarizing the various lithologies encountered in drillhole ATT-09-005C are shown in Appendix 1.

Core logging activities completed on site at the Victor Mine involved the identification and description of the various lithologies encountered in the drillhole (grain size, sorting, bed thickness, cognate olivine size, and indicator mineral content) as well as estimates of the frequency and type of xenoliths (mudstone, limestone, basement lithologies) contained within the kimberlite. Additionally, a number of geotechnical parameters were measured on the drill core including core recovery, rock quality designation, magnetic susceptibility, density and intact rock strength. A digital photographic record of the core was also completed as an aid to future geotechnical studies if required.

5.0 RESULTS

5.1 Core Logging

The results of core logging indicate a very thin intersection of kimberlite (6.33-14.79 m) was obtained in drillhole ATT-09-005C which tested the Logan target (Appendix 1). The hypabyssal kimberlite obtained in the drillhole was seen to contain an unusually low abundance (10-15%) of olivine, most of which were seen to occur as fine grained olivine phenocrysts. The scarcity of olivine and the lack of kimberlitic indicators (garnet, orthopyroxene, spinel and ilmenite) in the drillcore indicate a low petrographic interest rating for this body.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Notwithstanding the relatively narrow intersection of kimberlite obtained in drillhole ATT-09-005C, microdiamond sampling is recommended to confirm the low interest rating forecast for the Logan kimberlite by core logging.

Further examination of existing airborne and ground mag data is also recommended in order to compare the response of the Logan kimberlite to that of other kimberlites in the Attawapiskat cluster which are known to contain greater thickness of kimberlite.

7.0 PERSONNEL

Corehole drill testing of the Logan kimberlite was successfully undertaken in a safe and efficient manner, with no lost time incidents or accidents recorded by De Beers or its external contractors during 37 mandays of work undertaken on the project.

The manday distribution list for De Beers and its external contractors during the Logan drilling project is listed in Appendix 2.

8.0 BIBLIOGRAPHY

Bostock, H.H., 1968:
Precambrian Sedimentary Rocks of the Hudson Bay Lowlands *in* Earth Science Symposium on Hudson Bay, Geological Survey of Canada Paper 68-53, pp. 206-214.

Bostock, H.H., 1971:
Geological Notes on Aquatuk River Map Area, Ontario, with Emphasis on the Precambrian Rocks, Geological Survey of Canada Paper 70-42, 57 p.

Bostock, H.S., 1976:
Physiographic Subdivisions of Canada *in* R.J.W. Douglas (ed.) Geology and Economic Minerals of Canada – Part A, pp. 10-30.

Card, K.D., 1990:
A Review of the Superior Province of the Canadian Shield, a product of Archean accretion, *Precambrian Research*, Vol. 48, Nos. 1-2, pp. 99-156.

Craig, B.G., 1968:
Late-Glacial and Postglacial History of the Hudson Bay Region *in* Earth Science Symposium on Hudson Bay, Geological Survey of Canada Paper 68-53, pp. 63-77.

Cumming, L.M., 1968:
Rivers of the Hudson Bay Lowlands *in* Earth Science Symposium on Hudson Bay, Geological Survey of Canada Paper 68-53, pp. 144-168.

Donaldson, J.A., 1986:
Precambrian Geology *in* I.P. Martini ed., Canadian Inland Seas, Elsevier Oceanography Series, 44, pp. 1-15.

Johnson, R.D., Joubin, F.R., Nelson, F.J. and Olsen, E., 1986:
Mineral Resources *in* I.P. Martini ed., Canadian Inland Seas, Elsevier Oceanography Series, 44, pp. 387-402.

Kong, J.M., Boucher, D.R. and Scott-Smith, B.H., 1999:
Exploration and Geology of the Attawapiskat Kimberlites, James Bay Lowland, Northern Ontario Canada, *in* Proceedings of the 7th International Kimberlite Conference, J.J. Gurney, J.L. Gurney, M.D. Pascoe and S.H. Richardson ed., V.1, pp-452-467.

Martini, I.P., 1989:
The Hudson Bay Lowland: major geological features and assets, *Geologie en Mijnbouw,* Vol 68, pp. 25-34.

Maxwell, J.B., 1986:
A Climate Overview of the Canadian Inland Seas Biostratigraphy *in* I.P. Martini ed., Canadian Inland Seas, Elsevier Oceanography Series, 44, pp. 79-99.

Norris, A.W., 1986:
Review of Hudson Platform Paleozoic Stratigraphy and Biostratigraphy *in* I.P. Martini ed., Canadian Inland Seas, Elsevier Oceanography Series, 44, pp. 17-38.

Norris, A.W. and Sanford, B.V., 1968:
Paleozoic and Mesozoic Geology of the Hudson Bay Lowlands *in* Earth Science Symposium on Hudson Bay, Geological Survey of Canada Paper 68-53, pp.169-205.

Prest, V.K., 1968:
Retreat of Wisconsin and Recent ice in North America; speculative ice-marginal positions during recession of the last ice-sheet complex. Ice-marginal positions, Geological Survey of Canada Map 1257A, 1:5,000,000 scale.

Sado, E.V. and Carswell, B.F., 1987:
Surficial Geology of Northern Ontario, Ontario Geological Survey Map 2518, scale: 1:1,200,000.

Sanford, B.V., Norris, A.W. and Bostock, H.H.,1968:
Geology of the Hudson Bay Lowlands (Operation Winisk), Geological Survey of Canada Paper 67-60, 118 p.

Sanford, B.V. and Norris, A.W., 1975:
Devonian Stratigraphy of the Hudson Platform, Geological Survey of Canada Memoir 379, 124 p.

Sanford, B.V. and Grant, A.C.: 1990:
New Findings Relating to the Stratigraphy and Structure of the Hudson Platform, *in* Current Research, Part D, Geological Survey of Canada Paper 90-1D, pp. 17-30.

Shilts, W.W., 1986:
Glaciation of the Hudson Bay Region Biostratigraphy *in* I.P. Martini ed., Canadian Inland Seas, Elsevier Oceanography Series, 44, pp. 55-78.

Skinner, R.G., 1973:
Quaternary Stratigraphy of the Moose River Basin, Ontario, Geological Survey of Canada Bulletin 225, 77 p.

Suchy, D.R. and Stearn, C.W., 1993:
Evidence of a Continent-wide Fault System on the Attawapiskat River, Hudson Bay Platform, Northern Ontario, *Canadian Journal of Earth Sciences*, Vol. 30, No. 8, pp.1668-1673.

Thorleifson, L.H., Wyatt, P.H. and Warman, T.A., 1993:
Quaternary Stratigraphy of the Severn and Winisk Drainage Basins, Northern Ontario, Geological Survey of Canada Bulletin 442, 59 p.

Thurston, P.C., Sage, R.P. and Siragusa, G.M., 1979:
Geology of the Winisk Lake Area, District of Kenora, Patricia Portion, Ontario Geological Survey Report 193, 169 p.

van Straaten, B., Kopylova, M.G., Russell, J.K., Webb, K.J. and Scott-Smith, B.H., 2008:
Stratigraphy of the Intra-crater Volcaniclastic Deposits of the Victor Northwest Kimberlite (Canada), 9th International Kimberlite Conference Extended Abstract No. 9IKC-A-00292.

Webb, K.J., 2004:
Overview of the Discovery, Evaluation and Geology of the Victor Kimberlite, Attawapiskat, Northern Ontario, 8th International Kimberlite Conference, Northern Ontario Field Trip Guidebook, B.A. Kjarsgaard, ed.

Webb, K.J., Scott-Smith, B.H., Paul, J.L. and Hetman, C.M., 2004:
Geology of the Victor Kimberlite, Attawapiskat, Northern Ontario, Canada: Cross-cutting and Nested Craters *in* Selected Papers of the 8th International Kimberlite Conference – Volume 1, Lithos, Vol. 76, pp. 29-50.

Figure 1: Project Location Map.

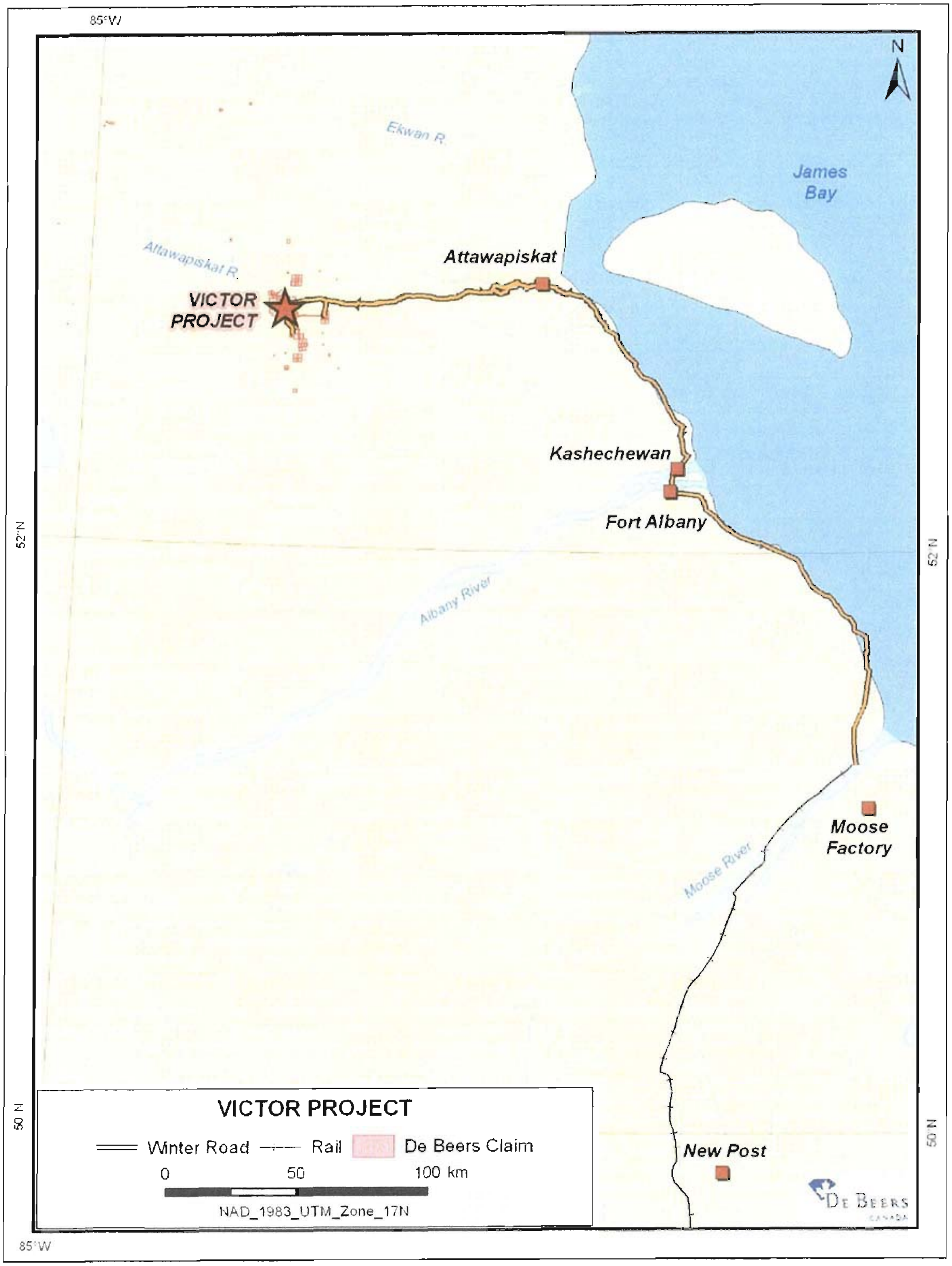

Figure 2: Location of the Logan Kimberlite.

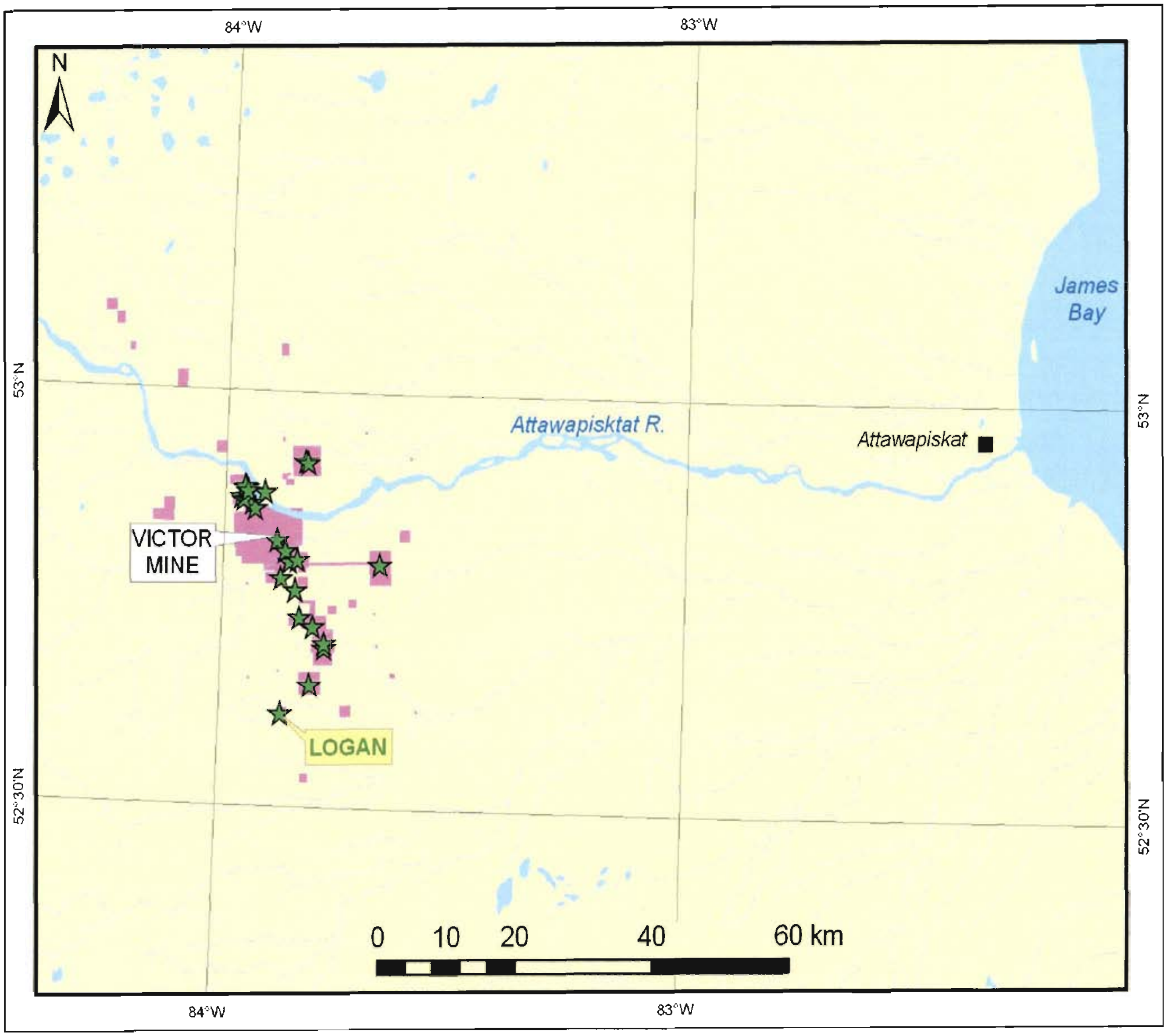

Figure 3: Logan Kimberlite Claim Location Map.

Map datum: NAD83, Zone 17

Figure 4: Tectonic Elements of the Rae-Hearne and Superior Structural Provinces.

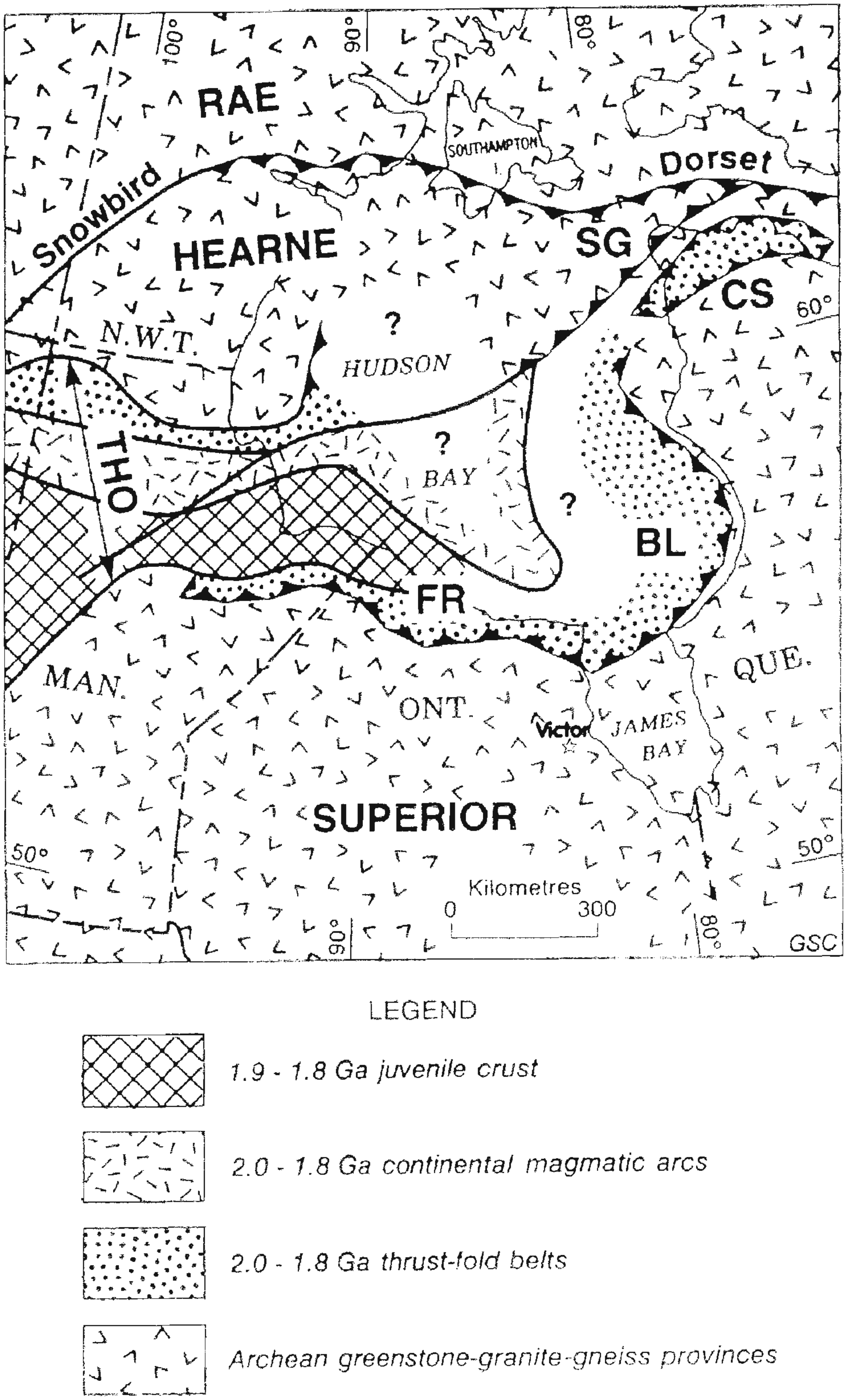

Figure 5: Lithological Succession of the Hudson Platform.

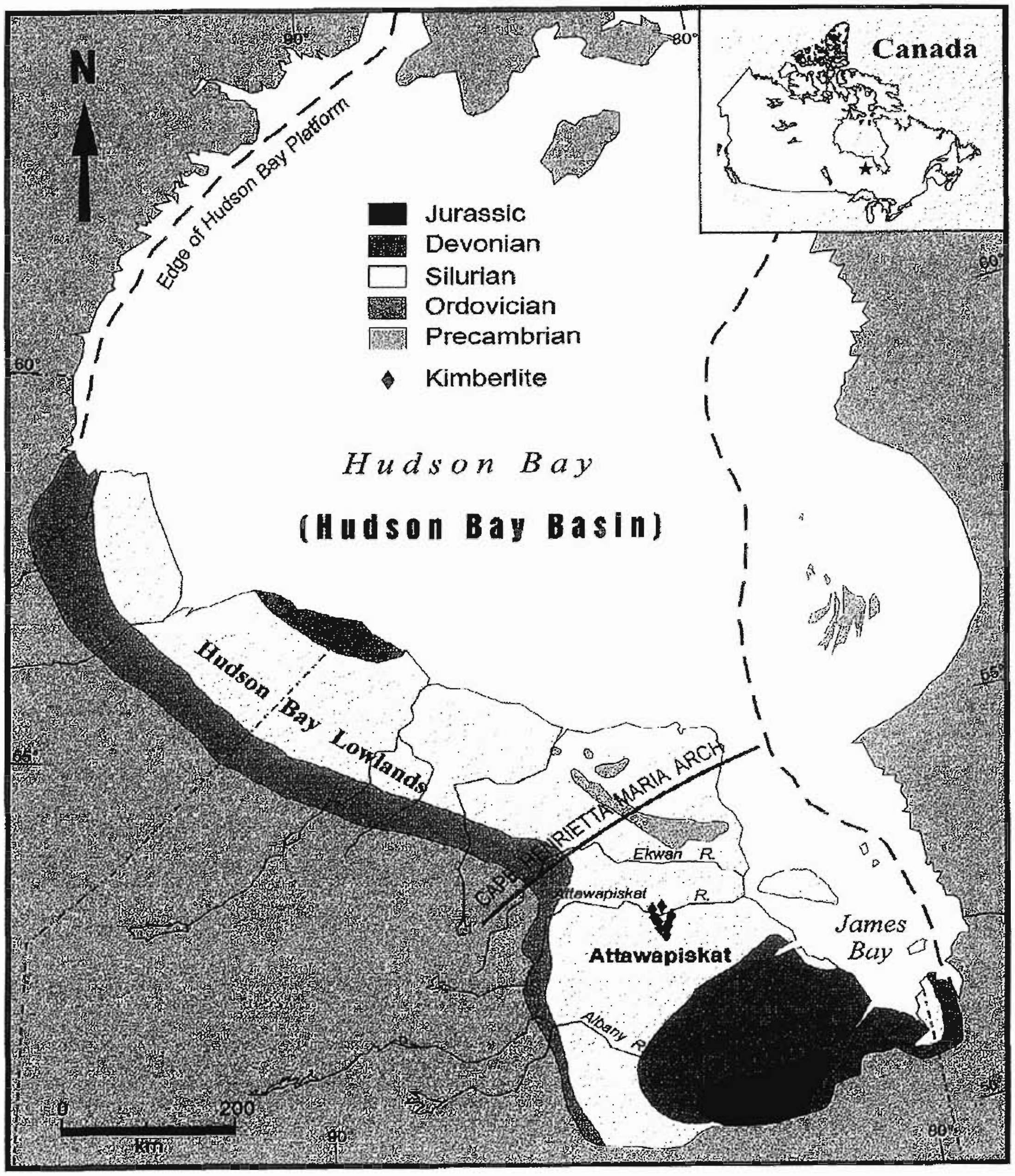

Figure adapted from Norris, 1986

Figure 6: Structural and Stratigraphic Section – Hudson Bay and Moose River Basins.

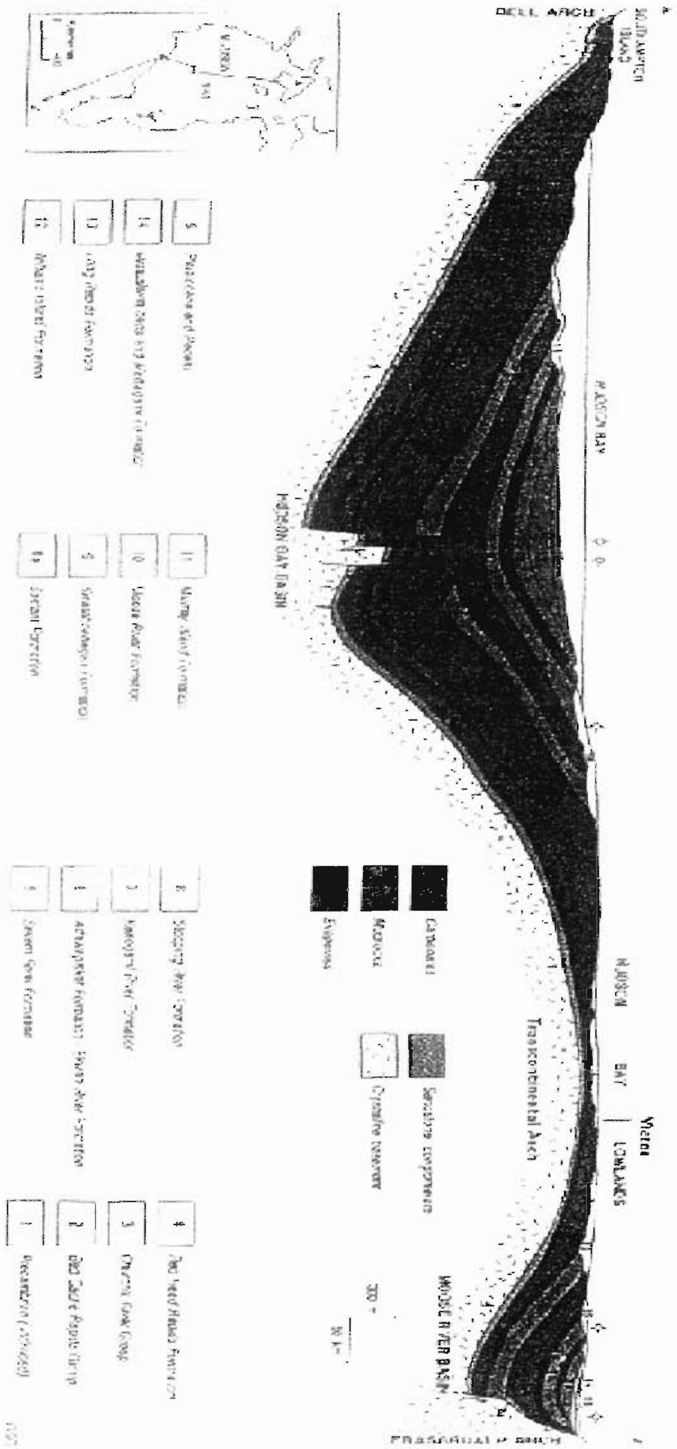

Figure adapted from Sanford and Grant (1990)

Figure 7: Country Rock Stratigraphy in the Vicinity of the Victor Kimberlite.

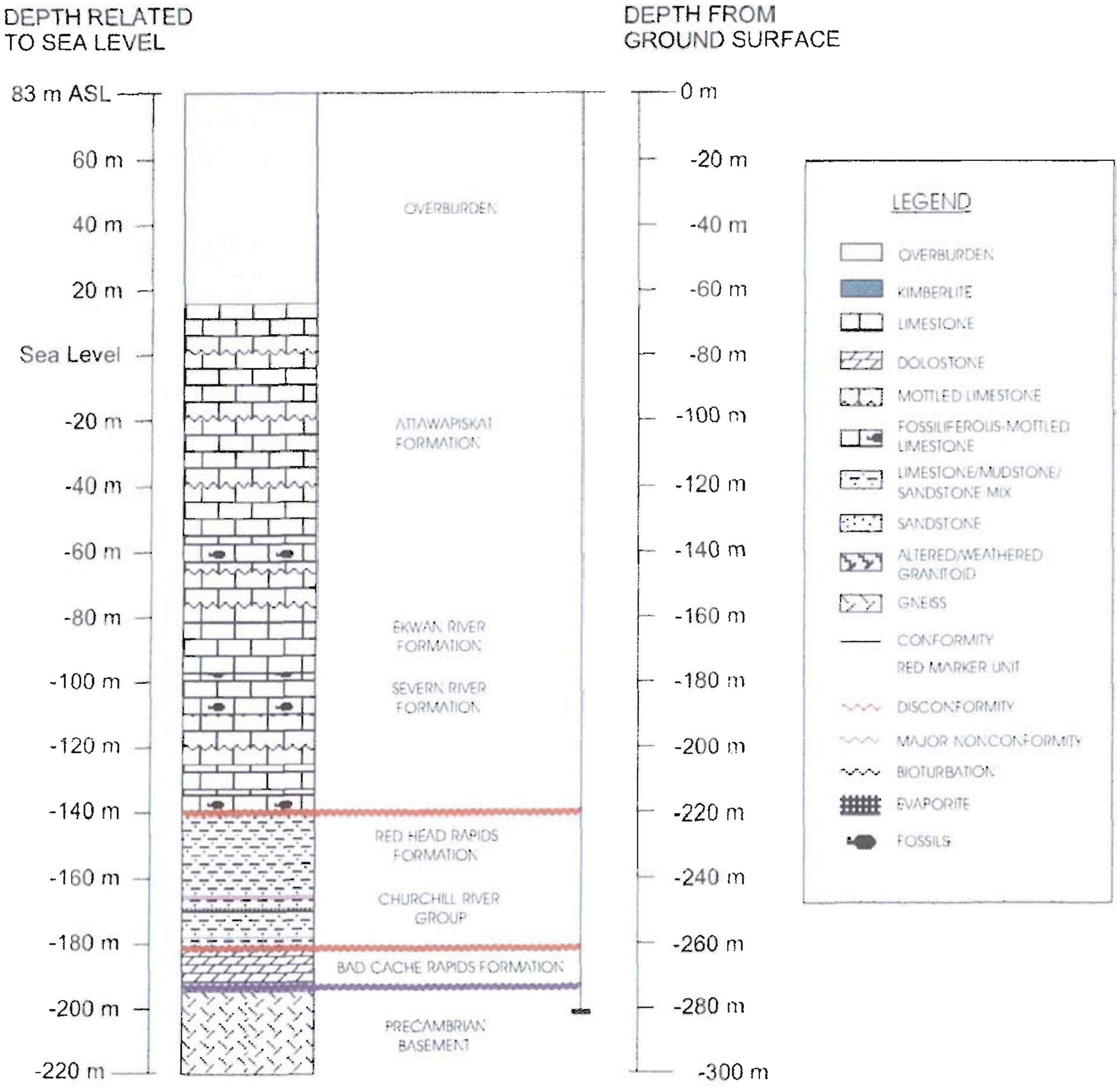

Figure 8: Drillhole ATT-09-005C Location – Logan Kimberlite.

Map datum: NAD83, Zone 17

Appendix 1: Corehole Logs - 2009 Logan Drilling

DRILL LOG: ATT-09-005

DRILL HOLE: ATT-09-005	AZIMUTH: NA
KIMBERLITE: TBD	CORE LOCATION: Victor Camp (core will be moved to Sudbury)
CORE DIAMETER: NQ	DATE LOGGED: 08 May 2009 (1 day)
BOXES EXAMINED: 1 to 20	LOGGED BY: Stephan Kurszlaukis
INTERVAL LOGGED: 6.33 m to 99.00 m	CORE REVIEWED BY:
EOH: 99.00 m DIP: -90°	DRILL LOG REVIEWED BY:

PRE-LOGGING NOTES: This is the first kimberlite logged from this body by the author.

CONDITION OF DRILL CORES: Core is in good condition with moderate to good textural and mineral preservation.

LOG OVERVIEW:

FROM (m)	TO (m)	LITHOLOGY	ZONE	LENGTH (m)
0	6.33	Glacial till (not recovered)	OVB	6.33
6.33	14.79	F-HK	FHK	8.46
14.79	99.00	Limestone (Attawapiskat FM?)	LS	84.21
99.00		End of hole	ECH	

SUMMARY OF GEOLOGY: The core shows a shallow and relatively short intersection of fine-grained hypabyssal kimberlite (HK) underlain by over 84 m of limestone. The HK shows an unusual low abundance of olivine (between 10 and 15%), most of which are fine-grained olivine phenocrysts of similar grain size (0.05 to 1.5mm). Larger olivines are hardly observed; the few olivine macrocrysts (large phenocrysts?) reach a size of 6 mm. The groundmass is comprised of phlogopite (<1mm) and spinel, set in a grey-brown base most likely made up of serpentine and some minor carbonate. The xenolith abundance is low (varies between 5 and 10%) and comprises mostly small, angular to subround limestone fragments of grey and cream colour. Basement xenoliths represent about 30-40% of the xenolith population, appear in similar shape and size as the limestones and are usually strongly altered. Mantle xenoliths or indicator minerals were not observed.

The scarcity of olivine in general and its dominantly phenocrystic nature together with an apparent absence of mantle indicator minerals suggest a low petrographic interest rating for this kimberlite. However, there is only very little kimberlite intersected and the kimberlite under observation may be a late intrusion along the pipe wall, which are often of low interest and would not be representative for the entire pipe.

BRIEF DRILL LOG: ATT-09-005C

FROM (m)	TO (m)	DESCRIPTION	ZONE
0	6.33	Glacial overburden; not recovered.	OVB
6.33	14.79	F-HK Light to dark green and grey kimberlite, which changes colour to light and dark brown in alteration zones. Colour change can be abrupt or gradational and is usually linked to the presence of carbonate-filled cracks (Fig. 1). In all cases the colour changes are secondary and not related to a different rock type. The rock is hard, but between 14 and 14.79 m (the contact to the country rock) the kimberlite is highly altered, soft and friable. The bottom contact of the kimberlite with the underlying limestone is sharp and at an angle of 30 degrees.  Fig. 1: Note the distinct and sharp colour change which is linked to calcite veining. The kimberlite contains olivine in low abundance (10 to 15 %, locally up to 20 %). Most olivine is phenocrystic in nature and occurs in the groundmass of the rock as small (0.05 to 1.5 mm), well sorted minerals. The olivine phenocrysts are prismatic in shape and euhedral to subhedral. Complex shapes are moderately rare. The few (1-3 %) olivines which are larger reach sizes up to 6 mm and show subhedral, phenocrystic shapes. Many of the larger olivines appear round, although distinct embayment textures were only scarcely observed. They are either xenocrystic in nature or represent large phenocrysts. The abundance of larger olivines varies slightly within the core, which is likely an effect of flow separation rather than separate intrusive phases. All olivine appears serpentine altered. Compared to kimberlites world wide the olivine abundance is very low (usually at around	HK

FROM (m)	TO (m)	DESCRIPTION	ZONE
		50%). Phlogopite is a major groundmass constituent and occurs as small (<1 mm), well defined grains. Poikilitic phlogopite was not observed under the binocular. A further groundmass phase is spinel. Both phlogopite and spinel do not make up more than 15 to 20 % of the kimberlite. The remainder of the rock is made up of irresolvable light grey to brown material, most likely serpentine, and some white carbonate, which may locally become slightly segregationary in texture if more frequent (for example between 11.12 and 11.31m). The xenolith abundance varies between 5 and 10% and comprises mostly small (<**1.5**-3 cm), angular to subround limestone fragments of grey and cream colour. Limestone xenoliths containing fossils or bioturbation were not noted. Basement xenoliths represent about 30-40% of the xenolith population, appear in similar shape and size as the limestones and are usually strongly altered. Mantle xenoliths or indicator minerals were not observed. Texturally the rock shows many features which can be expected from hypabyssal kimberlites. Olivines and phlogopites are locally flow-aligned and show an overall homogenous distribution throughout the core. Only one potential pyroclast was observed at 7.26 m, where a thin rim (1-2 mm) of very fine-grained kimberlite surrounds an altered basement clast (Fig. 2). No other clasts or larger olivines did show rims and occasional lighter coloured rims around xenoliths are most likely related to alteration and do not represent pyroclastic selvages.  Fig. 2: A single possible juvenile pyroclast with a fine-grained kimberlite selvage is present in the rock. At 8.87 m one limestone clast has a high abundance of groundmass carbonate at its bottom end, suggesting that it presented an obstacle to a rising carbonate fluid (Fig. 3). This	

FROM (m)	TO (m)	DESCRIPTION	ZONE
		is typically observed in HK's.  Fig. 3: Carbonate is concentrated at the bottom of a xenolith (at the right margin of the xenolith). Also, a short (12 cm at 10.8 m) and thin (1-1.5 cm) dyke-like vertical occurrence of very fine-grained kimberlite with a wavy but sharp outline to the surrounding kimberlite (Fig. 4) suggests local flow separation processes typically found in HK's.  Fig. 4: The vertical vein is composed of very fine-grained kimberlite and represents likely a late-stage fluid segregation. The kimberlite is most likely intrusive in nature and thus an HK, although the single possible pyroclast structure also allows for an interpretation as a welded tuff. Due to the short kimberlite intersection and the location at the country rock contact, the HK may represent a late intrusion along a pipe margin which is often not representative for the remaining kimberlite.	
14.79	99.00	Limestone The top contact of the limestone with the overlying kimberlite is sharp and at an angle of 30 degrees (Fig. 5). The angle is very low for an authentic pipe contact and it should be	LS

FROM (m)	TO (m)	DESCRIPTION	ZONE
		checked whether the limestone is *in situ*.  Fig. 5: The kimberlite/limestone contact dips shallow with 30 degrees. The light grey to cream coloured limestone contains occasional reef fossils and bioturbation. The limestone is in places vuggy, the cavities are especially frequent in areas with elevated fossil counts. Bed thicknesses are, if preserved, on a cm scale. The beds lie horizontal or dip with about 10 to 15 degrees from horizontal. From 17 to 19.3 m the limestone has light brown to grey colour, is soft and has large pore spaces (Fig. 6). No fossils are apparent. It appears highly altered, which may be related to the emplacement of kimberlite. Core loss between 17 and 18 m (6 cm LS recovered). Grey layer in between 88 and 92 m.  Fig. 6. The limestone close to the kimberlite contact appears altered.	
99.00	99.00	End of hole. Core ends in limestone.	EOH

Appendix 2: Manday Distribution - 2009 Logan Corehole Drilling Program

Personnel	**MAY 2009**																															
De Beers Canada Inc.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	**Total**
Leyla Hoosain - Senior Project Manager	pm	pm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Charley Murphy - Project Geophysicist	g	g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Mary-Anne Hildebrandt - Project Geol	pm	pm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Stephan Kurszlaukis - Petrologist	-	-	-	-	-	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Chris Redhead - SHE Co-ordinator	s	s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Jennifer Klebert - SHE Co-odinator	s	s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Daniel St-Pierre - Field assistant	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
																					De Beers Canada Inc. total:											13
Attawapiskat First Nation																																
Michel Iahtail - Field assistant	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Joseph Ron Kataquapit - Field assistant	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Virgil Wesley - Field assistant	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
																					Attawapiskat First Nation total:											6
Helicopter Transport Services																																
Jean-Yves Lampron - Helicopter Pilot	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Stephan Caron - Helicopter Pilot	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Dave Gelinas - Helicopter Engineer	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
																					Helicopter Transport Services total:											6
Foraco Canada Limited																																
John Hill - Drill Foreman	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Scott Mattinson - Driller	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Darin Edwards - Drill Helper	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Jean Lasalle - Driller	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Remi Lasalle Drill Helper	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Stephane Larocque - Drill Helper	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
																					Foraco Canada Ltd total:											12
																															May mandays total:	37

Explanation of Codes: **m**: mobilization; **d**: demob; **s**: OH&S co-ordination, **D**: diamond drilling, **C:** core logging, **pm**: project management, **g**: geophysics, **F**: field assistant

H: helicopter support

De Beers Canada Inc.
2010 Assessment Report
Diamond Drilling Investigation of the Logan Kimberlite

Ministry of
Northern Development
and Mines

Ontario

Drill Hole Summary Sheet

Office Use Only
Folder Identification Number
Drill Hole Identification

DRILL HOLE IDENTIFICATION

Name of Claim Holder or Mining Land Holder
De Beers Canada Inc.

Company Hole Identification Number ATT-09-005C	MNDM Core Library Identification **(Office Use Only)**

CO-ORDINATE INFORMATION

Indicate method used to obtain drill hole location co-ordinate:

☐ Don't know
☐ NTS 1:250,000 map
☐ Paper claim map
☐ other
☐ GPS reading (Geographic Positioning System)
☐ NTS 1:50,000 map
☐ Sketch map
☐ MNDM CLAIMaps system
☐ Ontario OBM Series map
☒ Surveyed co-ordinates

DRILL HOLE COLLAR LOCATION CO-ORDINATES

Collar Location Co-ordinates. You may provide co-ordinates in UTM or Latitude and Longitude

2.44117

Datum	NAD 27 or 83	NAD 83
UTM	Zone 15, 16, 17 or 18	Zone 17
	Easting	305977.8
	Northing	5832989.4
Latitude and longitude data (degrees/minutes/seconds or decimal values)	Latitude	
	Longitude	

RECEIVED
APR 27 2010
GEOSCIENCE ASSESSMENT
OFFICE

OTHER DRILL HOLE DATA

Hole Type (examples percussion, diamond drill, underground)	NQ core hole
Year Drilled	May 1-2, 2009
Azimuth	°
Dip	-90.0 °
Length (metres)	99.0
Overburden Depth (metres)	6.33 m